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Guide to Starters

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Guide to starters

1 Contents

1 Contents 2
2 Introduction 4
3 Definitions (important technical parameters of a starter) 4
3.1 Partial discharge inception voltage or ignition voltage 4
3.2 Closure voltage 4
3.3 Non-reclosure voltage 4
3.4 Pulse or surge voltage 4
4 Starters ST 111 / ST 151 (LONGLIFE starters) 5
4.1 Design 5
4.2 Operation 5
4.3 Operating mode 6
4.4 Technical data sheets for starters ST 111, ST 15 6
5 DEOS® starters ST 171 / ST 172 / ST 172 SAFETY 7
5.1 Design 7
5.2 Operation 7
5.3 Operating mode 7
5.4 Technical data sheets for DEOS® starters ST 171, ST 172, ST 173 SAFETY 7
6 Overview of starters 8
7 RoHS 9
8 Disposal 9
9 Troubleshooting 9
9.1 Observation: the lamp fails to ignite, the starter switches without interruption 9
9.2 Observation: the lamp fails to ignite, the DEOS® SAFETY starter has reacted 9
9.3 Observation: the lamp fails to ignite, the electrodes glow, the starter does not switch 9
9.4 Observation: the lamp fails to ignite, the electrodes glow, the SAFETY starter has reacted 9
9.5 Observation: blackening of the ends/blackening near the electrode coils 9
9.6 Observation: the lamp does not start, the starter casing has a brown discoloring 10
9.6 Observation: radio interference 10
9.7 Observation: the lamp ignites and goes out at short intervals 10
9.8 Observation: damp-proof luminaire, cover cap over the opening for the start discolored brown or the lamp ignites and goes out at short intervals 10
9.10 Observation: after the lamp and/or starter has been replaced the SAFETY starter does not produce ignition 10
9.11 Observation: the DEOS SAFETY starter trips during operation 10
9.12 Important: ST 171 SAFETY, ST 172 SAFETY, ST 173 SAFETY, before fitting 10

10 Technical data sheets 11
10.1 ST 111 HT LONGLIFE starter 11
10.2 ST 111 LONGLIFE starter 12
Starter St 111 LONGLIFE, for fluorescent lamps in single circuits 12
10.3 ST 151 LONGLIFE starter 13
10.6 DEOS® ST 171 SAFETY starter 14
DEOS St 171 SAFETY starter for fluorescent lamps in single circuits 14
10.7 DEOS® ST 172 SAFETY starter 15
DEOS St 172 SAFETY starter for fluorescent lamps in series circuits 15
10.8 DEOS® ST 173 SAFETY starter 16
DEOS St 173 SAFETY starter for fluorescent lamps in single circuits 16
11 Literature 17

2 Introduction

The function of starters is to preheat the electrodes of fluorescent lamps and generate an ignition pulse.

While the lamps are in operation the starters should consume little or no power and be ready to operate again as soon as the fluorescent lamps have been switched off.

A high-quality starter will last at least 40,000 on/off switching operations (such as OSRAM ST 111 LONGLIFE).

The DEOS® SAFETY Starter also reliably switches off the fluorescent lamps at the end of their lives.

3 Definitions (important technical parameters of a starter)

3.1 Partial discharge inception voltage or ignition voltage

This is the voltage at which partial discharge begins and the two bimetallic electrodes exhibit a clear glowing aura.
The current flowing at this point is not sufficient to close the bimetallic contacts.

3.2 Closure voltage

This is the value of the voltage at which the bimetallic contacts close.
The closure voltage indicates the line voltage up to which the starter can be used.

3.3 Non-reclosure voltage

This indicates the threshold voltage below which the bimetallic contacts can no longer close. The non-reclosure voltage is less than the closure voltage.

3.4 Pulse or surge voltage

The voltage that is generated in combination with the choke for igniting the lamp is known as the pulse or surge voltage.

4 Starters ST 111 / ST 151 (LONGLIFE starters)

4.1 Design

The glow starter contains the actual starter element, the glow igniter, and the radio interference suppression capacitor.

It is connected parallel to the lamp in series with the lamp electrodes.

Typical design of a glow igniter:

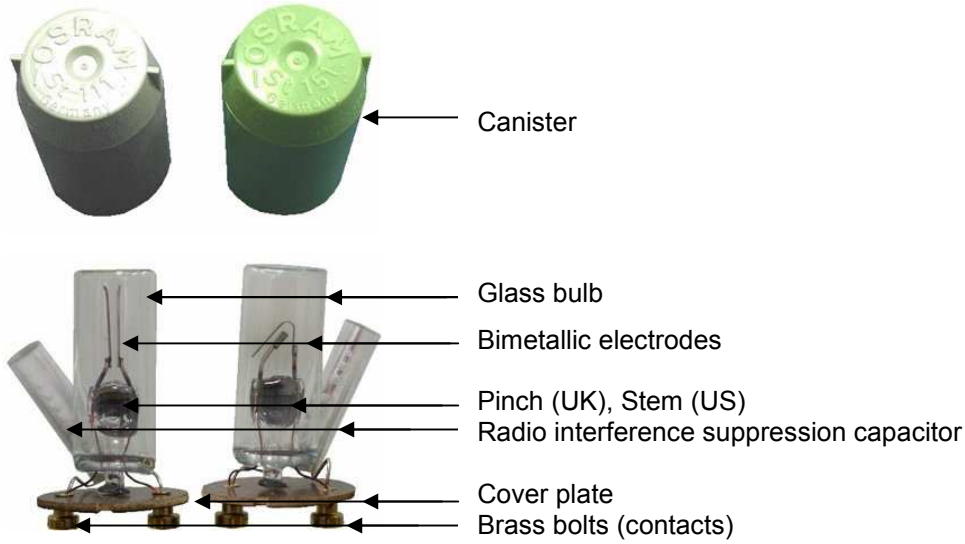


Figure 1: Design of a glow igniter

The filling mostly comprises a mixture of inert gas (neon, argon, helium) with hydrogen under a pressure of 20 to 100 mbar.

Bimetals consist of two different metal strips pressed one on the other which have different coefficients of thermal expansion.

4.2 Operation

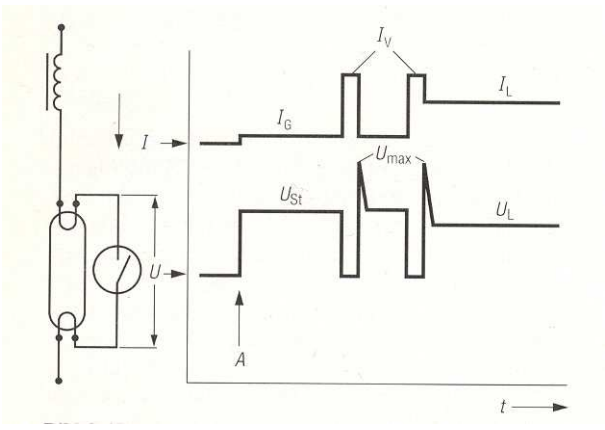


Figure 2: Fluorescent lamp circuit, preheating and starting operations for a fluorescent lamp

When line voltage is applied glow (partial) discharge starts between the bimetallic contacts. The applied voltage is higher than the partial discharge inception voltage and the closure voltage.

The glow current (I_G 20-40mA) heats up the bimetallic electrodes. These start to bend and touch each other once they have reached a certain temperature. This short-circuit causes glow discharge to stop. The full short-circuit current (I_V) of the choke then flows through the lamp electrodes.

The bimetallic contacts cool down and open again.

The energy stored in the choke now discharges. (induction law)

A voltage pulse (U_{max}) is generated which ignites the lamp.

Once the lamp has ignited only the lamp voltage (U_L) is applied at the glow starter. This voltage is less than the partial discharge inception voltage. It is so low that there can be no further glow discharge between the bimetallic contacts.

The strength of the generated voltage pulse depends on a large number of parameters:

- the time of phase relation at opening
- the gas filling
- the speed at which the bimetallic electrodes break

Voltage pulses of 1000V up to 1500 V are achieved for igniting the fluorescent lamps.

4.3 Operating mode

As the voltage pulse is dependent on the phase relation (energy stored in the choke) there is a chance that the lamps will not ignite despite good preheating of the lamp electrodes.

In this case, the glow igniter ignites again and repeats the preheating process and the ignition attempt – and continues to do so until the lamp ignites.

The lamp voltage increases right up to the end of the life of the fluorescent lamp.

If the lamp voltage exceeds the closure voltage of the glow igniter the lamp is short-circuited and goes out. A new ignition process then takes place.

If this behavior is repeated periodically in a short time the lamp will flicker or flash. This flickering may cause damage to the control gear.

A large number of unsuccessful ignition attempts will cause the starter to age.

If a new lamp is operated with an old starter the new lamp will exhibit premature blackening at its ends due to sputtering of the emitter on the lamp electrodes. This leads to accelerated aging of the lamp and therefore to premature failure.

For this reason the starter must always be replaced together with the old fluorescent lamp.

4.4 Technical data sheets for starters ST 111, ST 151

The technical data sheets are given in section 10.

5 DEOS® starters ST 171 / ST 172 / ST 172 SAFETY

5.1 Design

In contrast to the starters in Section 4, the DEOS ® starter has an NTC resistor (negative temperature coefficient) and a bimetallic switch.

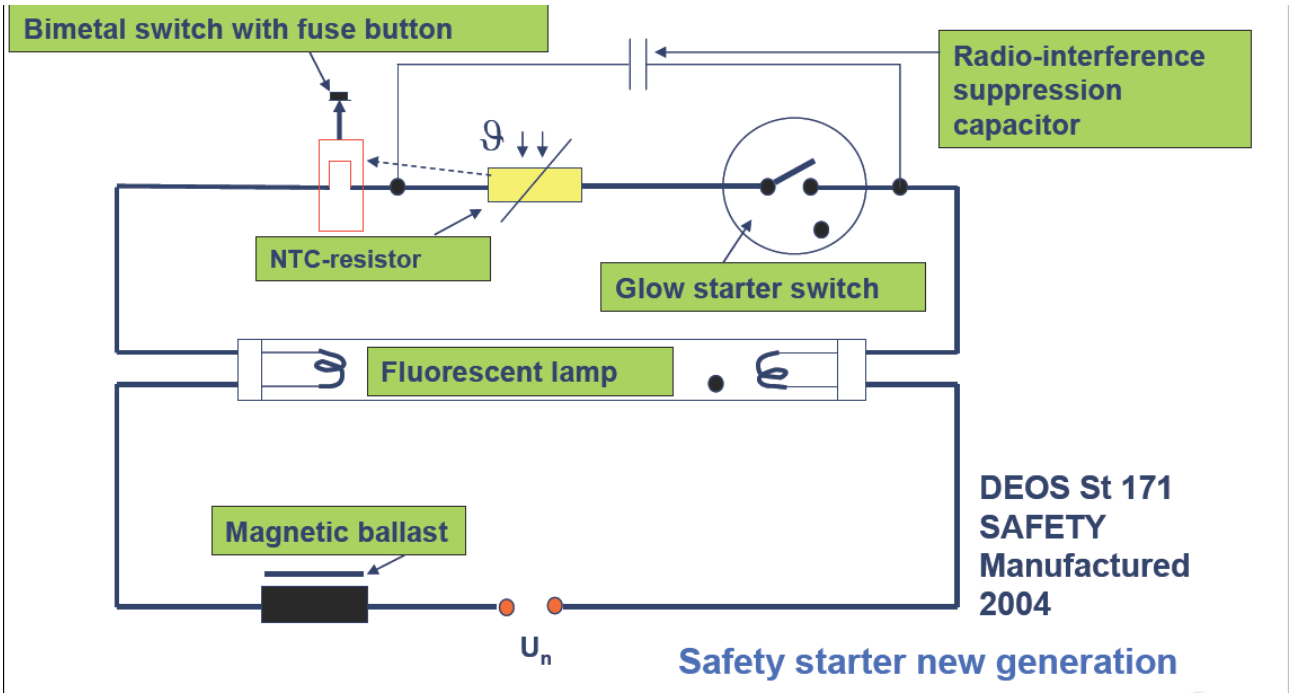


Figure 3: Circuit diagram for the DEOS® SAFETY starter

5.2 Operation

Ignition as described for the starters in Section 4.2.

In addition, fluorescent lamps that are faulty or at the end of their lives are safely and reliably shut down.

5.3 Operating mode

Normal operation is the same as described in Section 4.3.

In addition:
If the lamp can no longer be ignited at the end of its life or if there are repeated ignition attempts (flashing) the heat that is generated by the NTC (hot conductor) is used to trip the bimetallic switch. This then opens the circuit.

The lamp should now be replaced.

Press the red button back into the starter casing **(disconnect from the power supply first)**. The starter is now ready to operate again and can ignite the lamp.

This ability of the starter to shut down lamps that are faulty or are at the end of their lives enhances the SAFETY, convenience and life of a lighting system.

5.4 Technical data sheets for DEOS® starters ST 171, ST 172, ST 173 SAFETY

The technical data sheets are given in section 10.

6 Overview of starters

An overview of the types currently available is given below.

Lamp and starter combinations																
	For fluorescent lamps													For DULUX L and F lamps		
Single operation at 230V	4, 6, 8W	10, 13W	15, 16W	18, 20W	22W	30, 32W	38W	36, 40W	75/85W (1800 mm) 125W (2400mm)	58, 65W	80W	70, 100W	100, 115, 140W	18, 24W	36W	
ST 111 4)	x	x	x	x	x	x	x	x	-	x	x	-	-	x	x	
ST 171 4)	-	-	-	-	-	-	x	x	-	x1)	-	-	-	-	x	
ST 173 4)	-	-	x	x	x	x	-	-	-	-	-	-	-	x	-	
	For fluorescent lamps													For DULUX L and F lamps		
Series operation at 230V	4, 6, 8W	10, 13W	15W	18, 20W	22W	30, 32W	38W	36, 40W	50W (1500mm) 75/85W (1800 mm) 125W (2400mm)	58, 65W	80W	70, 100W	100, 115, 140W	18, 24W2)	36W	
ST 151 4)	x3)	-	x3)	x3)	x3)	-	-	-	-		-		-	x3)	-	
ST 172 4)	-	-	-	x3)	x3)	-	-	-	-		-		-	x3)	-	
	For DULUX Square lamps 4 pin															
Single operation at 230V	16W	28W	38W													
ST 111 4)	x	x	x													
1) Except L65W... UK 570 mm and L 80W																
2) Not suited for series connection of DULUX L and F 24W																
3) Also for single operation in 110/127V AC 50/60Hz																
4) Not suited für DULUX S/E, D/E, T/E and T/E IN in single and series operation																
SE 600**)	Replacement switch element for HID igniters															
ST 192**)	For HBO lamps, HBO 50W AC and HBO 100W/4															
STe 501**)	Replacement starter element for HID igniters															

7 RoHS

The starters meet RoHS requirements (**R**eduction **o**f **H**azardous **S**ubstances).

The glass used (bulb, exhaust stem, flare) is lead-free.

8 Disposal

The starters may be thrown away with household waste.

9 Troubleshooting

9.1 Observation: the lamp fails to ignite, the starter switches without interruption

Cause: The lamp voltage is too high (lamp at the end of its life)

Remedy: Replace the (compact) fluorescent lamp **and** starter (ST 111 LONGLIFE/ ST 151 LONGLIFE)

9.2 Observation: the lamp fails to ignite, the DEOS® SAFETY starter has reacted

Cause: The lamp voltage is too high (lamp at the end of its life)

Remedy: Replace the (compact) fluorescent lamp **and** press the red button on the starter **(disconnect from the power supply first)** (DEOS® ST 171, ST 172, ST 173 SAFETY)

9.3 Observation: the lamp fails to ignite, the electrodes glow, the starter does not switch

Cause: The bimetallic switch on the starter is stuck or there is a short-circuit at the compensating capacitor.

Remedy: Replace the starter – replace the old lamp at the same time.

9.4 Observation: the lamp fails to ignite, the electrodes glow, the SAFETY starter has reacted

Cause: The bimetallic switch on the starter is stuck or there is a short-circuit at the compensating capacitor.

Remedy: Replace the starter – replace the old lamp at the same time. Press the red button on the new DEOS® starter (**disconnect from the power supply first**).

9.5 Observation: blackening of the ends/blackening near the electrode coils

Cause: Oxide sputtering at end of life

Remedy: Replace the (compact) fluorescent lamp **and** starter (ST 111 LONGLIFE/ ST 151 LONGLIFE)

Remedy: Replace the (compact) fluorescent lamp **and** press the red button (DEOS® starter ST 171, ST 172, ST 173 SAFETY) (**disconnect from the power supply first**)

Cause: Extremely frequent switching

Remedy: Eliminate abnormal operation

9.6 Observation: the lamp does not start, the starter casing has a brown discoloring

Cause: The starter is at the end of its life, the bimetallic strips can no longer close

Remedy: Replace the lamp **and** starter

9.6 Observation: radio interference

Cause: The compensating capacitor is missing from the starter or is faulty

Remedy: Replace the starter

9.7 Observation: the lamp ignites and goes out at short intervals

Cause: The lamp is at the end of its life

Remedy: Replace the lamp **and** starter

9.8 Observation: damp-proof luminaire, cover cap over the opening for the start discolored brown or the lamp ignites and goes out at short intervals

Cause: The lamp is at the end of its life. The DEOS® SAFETY starter cannot trip because the distance to the cover cap over the opening for the start is not great correct.

Remedy: Replace the lamp. Insert an ST LONGLIFE starter; the DEOS SAFETY start is not suitable here.

9.10 Observation: after the lamp and/or starter has been replaced the SAFETY starter does not produce ignition

Cause: The SAFETY starter has tripped.

Remedy: Check whether the appropriate starter type has been inserted.

Cause: The SAFETY starter has tripped.

Remedy: Press the red button (DEOS® starter ST 171, ST 172, ST 173 SAFETY) (**disconnect from the power supply first**)

9.11 Observation: the DEOS SAFETY starter trips during operation

Cause: The DEOS SAFETY starter becomes too hot during operation of the lamp due to incorrect placement in the luminaire (too near the lamp coil) and/or excessively high ambient temperatures (see data sheet)

Remedy: Use ST 111 HT LONGLIFE.

9.12 Important: ST 171 SAFETY, ST 172 SAFETY, ST 173 SAFETY, before fitting.

Before fitting, it is recommended to press the red bottom on top of the canister of the starters, ST 171 SAFETY, ST 172 SAFETY, ST 173 SAFETY.
It avoid that the hook of the SAFETY mechanism don't fit well over the spring of the bimetallic switch.
None expected switch-off of the starter SAFETY mechanism is avoided after one ore more switch-on attempts of the lamp.

Technical data sheets

9.1 ST 111 HT LONGLIFE starter

Technical information

High-temperature St 111 HT LONGLIFE starter, for fluorescent lamps in single circuits

Product features

- St 111 HT LONGLIFE starter for fluorescent lamps L4W ...65W, 80W and OSRAM DULUX® L 18W, 24W, 36W in single circuits.
- **Life time > 60,000 switching cycles inductive operation.**
  Life time > 20,000 switching cycles capacitive operation
  Life time in acc. to IEC 155: minimum of 6000 switching cycles.
  Switching time: 1 minute, 30s on, 30s off
- **Service life approx. 10 years for inductive circuit.**
  Service life approx. 4 years for capacitive circuit.
  (for 2 switching operations per day).
- **Extension of lamp life by 20%.**
  Reason: Both lamp electrodes are evenly heated each time the lamp is ignited thanks to the symmetrical design of the bimetallic strip
- **Self-extinguishing plastic casing made of Makrolon.** Class V2
- Equipped with **special radio-interference suppression capacitor** (foil winding capacitor).
- Suitable for 220V-240V AC operation, 50/60 Hz
- **Cannot be used for OSRAM DULUX® S/E, D/E, T/E or T/E IN.**
- **Replace the starter each time the lamp is replaced.**
- **For use in ambient temperatures up to 100°C.**

Temperature range

-20°C to +100°C

Approval marks

ENEC 10 VDE

Label

CE label since 01.01.97

Protection class

Suitable for protection class II

Dimensions

According to international standard IEC 155, as per Fig. B.1

Length IEC max. 40.3 mm

Diameter IEC max. 21.5 mm

Range

Reference	Standard pack	EAN
St 111 HT 16x25er Tray OSRAM	25/400	4050300854021

Availability

From stock

9.2 ST 111 LONGLIFE starter

Technical information

Starter St 111 LONGLIFE, for fluorescent lamps in single circuits

Product features

- St 111 LONGLIFE starter for fluorescent lamps L4W...65W, 80W and OSRAM DULUX® L 18W, 24W, 36W in single circuits.
- **Life time > 60,000 switching cycles inductive operation**
  Life time > 20,000 switching cycles capacitive operation
  Life time in acc. to IEC 155 , minimum 6000 switching cycles.
  Switching time: 1 minute, 30s on, 30s off
- **Service life approx. 10 years for inductive circuit.**
  Service life approx. 4 years for capacitative circuit
  (for 2 switching operations per day).
- **Extension of lamp life by 20%**
  Reason: Both lamp electrodes are evenly heated each time the lamp is ignited thanks to the symmetrical design of the bimetallic strip.
- **Self-extinguishing plastic casing made of Makrolon.** Class V2
- Equipped with **special radio-interference suppression capacitor** (foil winding capacitor).
- Suitable for 220V-240V AC operation, 50/60 Hz
- **Cannot be used for OSRAM DULUX® S/E, D/E, T/E or T/E IN.**
- **Replace the starter each time the lamp is replaced**

Temperature range

-20°C to +80°C

Approval marks

ENEC 10 VDE

Label

CE label since 01.01.97

Protection class

Suitable for protection class II

Dimensions

According to international standard IEC 155, as per Fig. B.1

Length IEC max. 40.3 mm

Diameter IEC max. 21.5 mm

Range

Reference	Standard pack	EAN
St 111 16x25er Tray OSRAM	25/400	4050300854045
St 111 VS 1200	1200	4050300270166
St 111 BLI 2 OSRAM	2/20	4050300064000

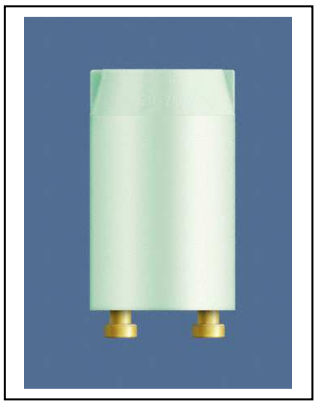
Availability

From stock

9.3 ST 151 LONGLIFE starter

Technical information

Starter St 151 LONGLIFE, for fluorescent lamps in series circuits



Product features

- St 151 LONGLIFE starter for fluorescent lamps L4W...22W and OSRAM DULUX® L 18W in series circuit.
- **Life time > 18,000 switching cycles inductive operation, Life time > 9000 switching cycles capacitive operation**. Life time in acc. to IEC 155: minimum of 6000 switching cycles, Switching time: 1 minute, 30s on, 30s off
- **Service life approx. 4 years for inductive circuit Service life approx. 2 years for capacitive circuit** (for 2 switching operations per day).
- **Extension of lamp life by 20%. Reason: Both lamp electrodes are evenly heated each time the lamp is ignited thanks to the symmetrical design of the bimetallic strip**.
- **Self-extinguishing plastic casing made of Makrolon.** Class V2
- Equipped with **special radio-interference suppression capacitor** (foil winding capacitor).
- Suitable for 220V-240V AC operation. 50/60 Hz, series circuit and single circuit 4W ...22W at 110V/127V
- **Cannot be used for OSRAM DULUX® S/E, D/E, T/E or T/E IN.**
- **Replace the starter each time the lamp is replaced.**

Temperature range

-20°C to +80°C

Approval marks

ENEC 10 VDE

Label

CE label since 01.01.97

Protection class

Protection class II

Dimensions

According to international standard IEC 155, as per Fig. B.1

Length IEC max. 40.3 mm

Diameter IEC max. 21.5 mm

Range

Reference	Standard pack	EAN
St 151 16x25er Tray OSRAM	25/400	4050300854083
St 151 VS 1200 OSRAM	1200	4050300012803
St 151 BLI 2 OSRAM	2/20	4050300092638

Availability

From stock

9.4 DEOS® ST 171 SAFETY starter

Technical information

DEOS St 171 SAFETY starter for fluorescent lamps in single circuits

Product features

- DEOS St 171 SAFETY starter for fluorescent lamps L36W ...65W and OSRAM DULUX® L 36W in single circuits for inductive (> 60,000 switching cycles) and capacitive operation (> 30,000 switching cycles).
- Reliably disconnects faulty lamps under inductive or capacitive operating conditions. There is therefore no need to replace a single faulty lamp instantly. This in turn means longer re-lamping intervals and greater efficiency.
- Prevents unnecessary power consumption due to short-circuit currents as DEOS St 171 SAFETY switch-off at the end of lamp life.
- Protects the control gear and luminaire holders.
- With red SAFETY button which can be reset for immediate operation again.
- **Service life:** DEOS St 171 SAFETY starter approx. 10 years inductive and approx. 5 years capacitive (for 2 switching operations per day)
- **Extension of lamp life by 20%.**
  Reason: Both lamp electrodes are evenly heated each time the lamp is ignited thanks to the symmetrical design of the bimetallic strip.
- Self-extinguishing plastic casing made of Makrolon. Class V0
- Equipped with **special radio-interference suppression capacitor** (foil winding capacitor)
- Suitable for 220V-240V AC operation, 50/60 Hz
- **Cannot be used for OSRAM DULUX® S/E, D/E, T/E or T/E IN.**
- **When the luminaire is used for the first time, push in the red SAFETY button until it clicks.**
- **Application: For indoor and outdoor lighting, particularly where it is essential for burnt-out lamps to be reliably shut down.**

Temperature range

-20°C to +80°C

Approval marks

ENEC 10 VDE

Label

CE label since 01.01.97

Protection class

Protection class II

Dimensions

According to international standard IEC 155, as per Fig. B.1
Length IEC max. 40.3 mm
Diameter IEC max. 21.5 mm

Range

Reference	Standard pack	EAN
St 171 8x25er Tray OSRAM	25/200	4050300854106
St 171 VS 1200 OSRAM	1200	4050300422855
St 171 BLI 1 OSRAM	2/20	4050300421544

Availability

From stock

9.5 DEOS® ST 172 SAFETY starter

Technical information

DEOS St 172 SAFETY starter for fluorescent lamps in series circuits

Product features

- DEOS St 172 SAFETY starter for fluorescent lamps L15W ...22W and OSRAM DULUX® L 18W in series circuits for inductive (> 20,000 switching cycles) and capacitive operation (> 10,000 switching cycles).
- Reliably disconnects faulty lamps under inductive or capacitive operating conditions. There is therefore no need to replace a single faulty lamp instantly. This in turn means longer re-lamping intervals and greater efficiency.
- Prevents unnecessary power consumption due to short-circuit currents as DEOS St 172 SAFETY switch-off at the end of lamp life.
- Protects the control gear and luminaire holders.
- With red SAFETY button which can be reset for immediate operation again.
- **Service life:** DEOS St 172 SAFETY starter approx. 4 years inductive and approx. 2 years capacitative (for 2 switching operations per day).
- **Extension of lamp life by 20%.**
  Reason: Both lamp electrodes are evenly heated each time the lamp is ignited thanks to the symmetrical design of the bimetallic strip.
- Self-extinguishing plastic casing made of Makrolon. Class V0
- Equipped with **special radio-interference suppression capacitor** (foil winding capacitor)
- Suitable for 220V-240V AC operation, 50/60 Hz series circuits and single circuits 18W ...22W at 110V/127V
- **Cannot be used for OSRAM DULUX® S/E, D/E, T/E or T/E IN.**
- **When the luminaire is used for the first time, push in the red SAFETY button until it clicks.**
- **Application: For indoor and outdoor lighting, particularly where it is essential for burnt-out lamps to be reliably shut down.**

Temperature range

-20°C to +80°C

Approval marks

ENEC 10 VDE

Label

CE label since 01.01.97

Protection class

Protection class II

Dimensions

According to international standard IEC 155, as per Fig. B.1
Length IEC max. 40.3 mm
Diameter IEC max. 21.5 mm

Range

Reference	Standard pack	EAN
St 172 8x25er Tray OSRAM	25/200	4050300854069

Availability

From stock

9.6 DEOS® ST 173 SAFETY starter

Technical information

DEOS St 173 SAFETY starter for fluorescent lamps in single circuits

Product features

- DEOS St 173 SAFETY starter for fluorescent lamps L15W ...32W and OSRAM DULUX® L 18W and 24W in single circuits for inductive (> 60,000 switching cycles) and capacitive operation (> 30,000 switching cycles).
- Reliably disconnects faulty lamps under inductive or capacitive operating conditions. There is therefore no need to replace a single faulty lamp instantly. This in turn means longer re-lamping intervals and greater efficiency.
- Prevents unnecessary power consumption due to short-circuit currents as DEOS St 172 SAFETY switch-off at the end of lamp life.
- Protects the control gear and luminaire holders.
- With red SAFETY button which can be reset for immediate operation again.
- **Service life:** DEOS St 173 SAFETY starter approx. 10 years inductive and approx. 5 years capacitative (for 2 switching operations per day).
- **Extension of lamp life by 20%.**
  Reason: Both lamp electrodes are evenly heated each time the lamp is ignited thanks to the symmetrical design of the bimetallic strip.
- Self-extinguishing plastic casing made of Makrolon. Class V0
- Equipped with **special radio-interference suppression capacitor** (foil winding capacitor).
- Suitable for 220V-240V AC operation, 50/60 Hz
- **Cannot be used for OSRAM DULUX® S/E, D/E, T/E or T/E IN.**
- **When the luminaire is used for the first time, push in the red SAFETY button until it clicks.**
- **Application: For indoor and outdoor lighting, particularly where it is essential for burnt-out lamps to be reliably shut down.**

Temperature range

-20°C to +80°C

Approval marks

ENEC 10 VDE

Label

CE label since 01.01.97

Protection class

Protection class II

Dimensions

According to international standard IEC 155, as per Fig. B.1
Length IEC max. 40.3 mm
Diameter IEC max. 21.5 mm

Range

Reference	Standard pack	EAN
St 173 8x25er Tray OSRAM	25/200	4050300854120

Availability

From stock

10 Literature

Betriebsgeräte und Schaltungen für elektrische Lampen,	C.H. Sturm / E. Klein, ISBN 3-8009-1586-3
Lamps and lighting	J.R. Coaton / A.M. Marsden, ISBN 0-340-64618-7
Grundlagen Beleuchtungstechnik	R. Bear, ISBN 3-341-01497-7
Elektrotechnik, Lexikon für die Praxis	R. Müller, ISBN 3-341-01297-4

Subject to change without notice. Errors and omission excepted.

This information supersedes all previous information.